Gradient Descent Multivariable.

for each sample.

$$\theta_j := \theta_j - \alpha \frac{1}{m} \cdot \sum_{i=1}^{m} \left(h_\theta(x^{(i)}) - y^{(i)} \right) x_j^{(i)}.$$

$$X = \begin{pmatrix} - x - \\ - x_i - \\ - x_m - \end{pmatrix}$$

in our implementation,

$$\theta_j = \theta_j - \alpha \frac{1}{m} \cdot \sum_{i=1}^{m} \left(X^{(i)} \cdot \theta - y^{(i)} \right) \cdot x_j^{(i)}$$

$$= \theta_j - \frac{\alpha}{m} \sum_{i=1}^{m} \left(x^{(i)}\theta - y^{(i)} \right) x_j^{(i)}.$$

scalar.

$$= \theta_j - \frac{\alpha}{m} \sum \begin{pmatrix} -x^{(1)}\theta - y^{(1)} - \\ \vdots \\ x^{(m)}\theta - y^{(m)} \end{pmatrix} \cdot \left(x_j^{(1)} \; . \; . \; . \; x_j^{(m)} \right)$$

$$= \theta_j - \frac{\alpha}{m} \cdot \text{sum} \begin{bmatrix} (x^{(1)} \cdot \theta - y^{(1)}) \cdot x_j^{(1)} \\ \vdots \\ (x^{(m)}\theta - y^{(m)}) \cdot x_j^{(m)} \end{bmatrix}$$

$$= \theta_j - \frac{\alpha}{m} \cdot \left[\underset{\substack{\text{column vector} \\ (m \times 1)}}{\begin{pmatrix} | \\ X\theta - y \\ | \end{pmatrix}} \; \underbrace{\left(x_j^{(1)} \; . \; . \; . \; x_j^{(m)} \right)}_{(1 \times m)} \right]$$

same feature (j) in diff. samples.

$$= \theta_j - \frac{\alpha}{m} \cdot \left((X\theta - y) \cdot X(:, j) \right)$$

Question 3 Cash Flow Analysis.

Part A) We want to compare the present value of

① the machine cost

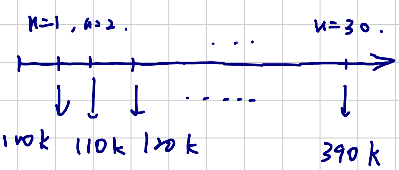
② annuity of labour cost.

$$PV_{labour} = 15000 \cdot (P/A, 12\%, 8)$$

$$= 15000 \cdot 6.1944 = 92\,916.$$

The maximum the company can pay for the machine is the present worth of the annuity cost from labour, \$ 92,916.

Part B) Option 1. PV growing annuity



$$PV = PV\text{ (base annuity)} + PV\text{ (arithmetic gradient annuity)}$$

$$= 100k \cdot (P/A, 8\%, 30) + 10k \cdot (P/G, 8\%, 30)$$

$$= 100k \cdot (11.2578) + 10k \cdot (103.4558)$$

$$= 2160.338\ k$$

$$= 2160,338$$

option 2 : $PV = 2500,000.$ ∴ option 2 (\$2500000 today) is a better option.

Part c).

① Get FV. of \$80,000 at 52 month.

② Get FV of annuity payment at 52 month., for 51 periods

③. Subtract ① − ②.

$n = 52$ (months) =

$r = \frac{12\%}{12} = 1\%$

Final payment = \$80,000 · (F/p, 1%, 52) − \$2000 (F/A, 1%, 51) · 1.01

= \$80,000 (1.6777) − 2000 · 66.1078 · 1.01

= 678.244

∴ Final payment is \$678.24.

Question 4. Comparison method.